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09/894,627	06/28/2001	John T. Boland	82531DMW	6130

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EXAMINER

TUCKER, WESLEY J

ART UNIT	PAPER NUMBER
2623	

DATE MAILED: 09/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/894,627	Applicant(s) BOLAND ET AL.	
	Examiner Wes Tucker	Art Unit 2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's amendment filed 7-22-05 has been entered and made of record.
2. Applicant has amended claims 1 and 9. Claims 1-17 remain pending.
3. Applicant's arguments have been fully considered but they are not persuasive for at least the following reasons:
 4. Applicant makes several arguments with regard to the citation of the reference to Sachdeva. Applicant argues that crucial aspects are not described in Sachdeva, such as obtaining data of an orthodontic structure is not fully described enough to anticipate the invention and that it would be impractical to perform a light scan or a laser scan on all surfaces of a patient's tooth using this type of apparatus and that scanning techniques in Sachdeva are implied as being performed on a plaster model. Applicant further argues that 2-D images are mapped onto a 3D model and that this is different from the present invention. Examiner appreciates the distinction between the workings of the two inventions, however these distinctions are not expressly reflected in the language of the claims. Examiner submits that the reference to Sachdeva sufficiently reads on the language used to describe the limitations in the claims. The differences cited above do not serve to distinguish the language of the

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claims from the reference of Sachdeva as reasonably broadly interpreted. Rejection in view of Sachdeva is therefore maintained.

5. Applicant has amended the independent claims 1 and 9 to add the limitation where the control target is in "close proximity to the object." Applicant explains that this means the target is "separate from the tooth." However in claim 16, recites "a rigid control target resting on said one or more teeth." Examiner submits that this exactly what Sachdeva discloses in column 4, lines 30-45. Sachdeva discloses a target or marking placed on the tooth. Sachdeva reads on the limitation in claim 16 and further also reads on the newly amended language of "in close proximity to the object." On the object still reads on "in close proximity to the object" and is therefore anticipated by Sachdeva. Rejection in view of Sachdeva is therefore maintained.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1-4, 7-12, and 14-16 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent 6,512,994 to Sachdeva.

With regard to claim 1, Sachdeva discloses a method for creating a dental model from a series of images of an intra-oral object, said method comprising the steps of

a) capturing a series of images of an intra-oral object from a plurality of capture positions (column 5, lines 50-57), where the object includes common surface features and a control target, in close proximity to the object, and arranged with respect to the object to provide control features (column 4, lines 35-40);

b) measuring the control features from the images of the control target included with the images of the object (column 4, lines 38-50);

c) analytically generating a 3-dimensional model of the object by photogrammetrically aligning the measurements of the control features, thereby providing a photogrammetrically aligned 3-dimensional model of the object while reducing image errors due to the variable orientations of the capture positions (column 4, lines 40-45 and column 5, lines 35-50, reducing the image errors due to the variable orientations are interpreted as the multiple x-ray scaling factors determined for multiple teeth), and

(d) adjusting the photogrammetrically aligned 3-dimensional model of the object by aligning the common features of the model to like features on an image of the object, thereby producing an aligned dental model from the series of images (column 5, lines 50-65).

With regard to claim 2, Sachdeva discloses the method as claimed in claim 1 wherein step (b) further includes the step of measuring the common features from the series of images of the object (column 5, lines 59-67). Here the common features are interpreted as the physical attributes on which reference points, which are measured, are to be placed.

With regard to claim 3, Sachdeva discloses the method as claimed in claim 1 wherein step (c) comprises the steps of:

performing a photogrammetric adjustment (column 4, lines 40-46); and

refining the photogrammetric adjustment by photogrammetrically projecting a 3-dimensional model of the target, determining misalignment of the control features and correcting the misalignment, thereby producing the photogrammetrically aligned 3-dimensional model of the object (column 4, lines 46-63 and column 5, lines 35-49, column 6, lines 52-67, column 8, lines 7-12). Here the first photogrammetric adjustment is interpreted as the scaling and the refinement is interpreted as the adjustment in the 3-D coordinate space pictured in figures 8 and 9.

With regard to claim 4, Sachdeva discloses the method as claimed in claim 1 wherein step (d) comprises the steps of:

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determining misalignment of the common features in the photogrammetrically aligned 3-dimensional model relative to the images of the object by photogrammetrically projecting the model onto an image of the object (Fig. 9, element 100 and Fig. 8); and applying a 3-dimensional morphing algorithm to correct for the misalignment (Fig. 8, element 82). Here Sachdeva discloses how the imaged reference points are used to determine misalignment, rotation, etc. of a tooth.

With regard to claim 7, Sachdeva discloses the method as claimed in claim 1 wherein the intra-oral object is one or more teeth (Figs. 2 and 3).

With regard to claim 8, Sachdeva discloses the method as claimed in claim 7 wherein the control target is positioned around said one or more teeth (Figs. 2 and 3).

With regard to claim 9, Sachdeva discloses a system for creating a dental model from a series of images of an intra-oral object, said system comprising:

- a camera for capturing a series of images of an intra-oral object from a plurality of capture positions (column 5, lines 50-57), where the object includes common surface features and a control target, in close proximity to the object, and arranged with respect to the object to provide control features (Figs. 2 and 3);

- photogrammetric means for measuring the control features from the images of the control target included with the images of the object (column 4, lines 37-54);

a digital processor including instructions for (a) analytically generating a 3-dimensional model of the object by photogrammetrically aligning the measurements of the control features, thereby providing a photogrammetrically aligned 3-dimensional model of the object while reducing image errors due to the variable orientations of the capture positions (column 4, lines 37-54 and column 5, lines 35-49); and (b) adjusting the photogrammetrically aligned 3-dimensional model of the object by aligning the common features of the model to like features on an image of the object, thereby producing an aligned dental model from the series of images (column 5, lines 50-57).

With regard to claim 10, Sachdeva discloses the system as claimed in claim 9 wherein said photogrammetric means further measures the common features from the series of images of the object (column 4, lines 35-40 and column 5, lines 50-57).

With regard to claim 11, Sachdeva discloses the system as claimed in claim 9 wherein said digital processor further includes instructions for performing a photogrammetric adjustment and refining the photogrammetric adjustment by photogrammetrically projecting a 3-dimensional model of the image, determining misalignment of the control features and correcting the misalignment, thereby producing the photogrammetrically aligned 3-dimensional model of the object (column 4, lines 46-63 and column 5, lines 35-49, column 6, lines 52-67, column 8, lines 7-12). Here the first photogrammetric adjustment is interpreted as the scaling and the refinement is interpreted as the adjustment in the 3-D coordinate space pictured in figures 8 and 9.

With regard to claim 12, Sachdeva discloses the system as claimed in claim 9 wherein said digital processor further includes instructions for determining misalignment of the common features in the photogrammetrically aligned 3-dimensional model relative to the images of the object by photogrammetrically projecting the model onto an image of the object and applying a 3-dimensional morphing algorithm to correct for the misalignment (Fig. 9, element 100 and Fig. 8, element 82).

With regard to claim 14, Sachdeva discloses the system as claimed in claim 9 wherein the intra-oral object is one or more teeth (Fig. 2).

With regard to claim 15, Sachdeva discloses the system as claimed in claim 14 wherein the control target is positioned around said one or more teeth (Fig. 2).

With regard to claim 16, Sachdeva discloses a method for creating a dental model from a series of images of one or more teeth, said method comprising the steps of:

(a) capturing a series of images of said one or more teeth from a plurality of capture positions (column 5, lines 50-55), where said one or more teeth include cusp and valley surface features (Figs. 4 and 5) describing their natural topographic surfaces and a rigid control target resting on said one or more teeth so as to provide control features (Figs. 2 and 3 and column 4, lines 35-45);

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(b) measuring the control features from the images of the control target included with the images of said one or more teeth (column 4, lines 35-45);

(c) analytically generating a 3-dimensional model of said one or more teeth by photogrammetrically aligning the measurement of the control features, thereby providing a photogrammetrically aligned 3-dimensional model of said one or more teeth while reducing image errors due to the variable orientations of the capture positions (column 4, lines 37-54 and column 5, lines 35-49); and

(d) adjusting the photogrammetrically aligned 3-dimensional model of said one or more teeth by aligning the cusp and valley surface features of the model to like features on an image of said one or more teeth, thereby producing an aligned dental model from the series of images (column 5, lines 50-57 and Figs.4 and 5). It is understood that all the features of the teeth including cusp and valley surfaces will line up when accurately matched.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 5, 6 and 13 rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,512,994 to Sachdeva in view of U.S. Patent 6,648,640 to Rubbert et al.

With regard to claim 5, Sachdeva discloses the method as claimed in claim 1, but does not explicitly disclose further comprising the step of using the aligned dental model to generate a dental restorative piece for the intra-oral object. Rubbert discloses a similar invention to that of Sachdeva in which 3-D model is generated with a CAD system (column 5, lines 60-63 and column 71) and is used to supply a 3-D model to a stereo lithography system that manufactures a plastic model of teeth (column 72, lines 26-29). Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to use the 3-D model generated by Sachdeva in combination with the plastic teeth manufacturing taught by Rubbert in order to generate a 3-D schematic for a replacement plastic tooth.

With regard to claim 6, Sachdeva discloses the method as claimed in claim 1, but does not disclose further comprising the steps of providing a database of generic 3-dimensional models and utilizing a selected one of the generic models in step (d) in the alignment of the common features of the photogrammetrically aligned 3-dimensional model to like features on the image of the object. Sachdeva discloses finding alignment or reference points that do not change throughout the course of treatment (column 6, lines 1-22). Rubbert discloses three dimensional virtual template tooth objects (column

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50, lines 38-40) for such purposes as in providing replacement teeth as they fit in a 3-D model. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to provide a data base of generic 3-D models in order to manipulate the models to see if a replacement tooth might fit in a patients mouth.

With regard to claim 13, the discussion of claim 5 applies.

8. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,512,994 to Sachdeva.

With regard to claim 17, Sachdeva discloses the method as claimed in claim 16 wherein the control features comprise vertices (column 8, lines 8-12) and discloses a rigid target (Fig. 2), but does not disclose wherein the rigid control target has a saddle form resting over said one or more teeth and the control features comprise vertices in the saddle form. However it would have been obvious to one of ordinary skill in the art at the time of invention to place any kind of rigid target on or around or on top of the tooth as a matter of design choice to give optimum or most appropriate scanning results.

Conclusion

9. Applicant's amendment necessitated the new grounds of rejection presented in the Office Action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wes Tucker whose telephone number is 571-272-7427. The examiner can normally be reached on 9AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on 571-272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Wes Tucker

9-6-05



VIKKRAM BALI
PRIMARY EXAMINER